A Knowledge-poor Pronoun Resolution System for Turkish

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Outline

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- System Architecture
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  - Preferences
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- Conclusion
- References
Anaphora resolution (AR) has various aspects including syntax, semantics and discourse.

Especially in late 90s, knowledge-poor strategy, which uses limited syntactic, semantic and domain knowledge in the resolution process, is widely employed:

- Kennedy and Boguraev (1996), Baldwin (1996), and Mitkov (1998) for English
- Palomar et al. (2001) for Spanish
- Trouilleux (2002) for French
- Tanev and Mitkov (2002) for Bulgarian
Introduction [2]

- Turkish is a non-configurational language.
- Studies on anaphora and anaphora resolution in Turkish include research on:
  - overt and zero representations of anaphora (Enç, 1986; Erguvanlı-Taylan, 1986),
  - a situation semantics approach to pronominal anaphora (Tın and Akman, 1994)
  - discourse anaphora from the perspective of Centering Theory (Turan, 1995)
  - resolution of dropped pronouns (T. Yöndem & Şehitoğlu, 1997),
  - anaphora generation (Yüksel and Bozşahin, 2002)
  - a computational model for pronoun resolution (Tüfekçi and Kılıçarslan, 2005) which uses Hobbs’ naive approach (Hobbs, 1978)
Introduction [3]

- We present
  - A knowledge-poor pronoun resolution system for Turkish which resolves third person personal and reflexive pronouns referring to proper person names.

- To our knowledge, this is the first fully specified knowledge-poor computational framework for pronoun resolution in Turkish.
System Architecture [1]

- The scope of the system is
  - Third person personal pronouns, ‘o’ (he/she) and ‘onlar’ (they)
  - Reflexive pronouns, ‘kendi’ (himself/herself), ‘kendisi’ (herself/herself) and ‘kendileri’ (themselves)
  - Inflections of these pronouns.
System Architecture [2]

- The strategy that the system employs is:
  - Identification of the anaphors to be resolved.
  - Location of the candidates for antecedents.
  - Selection of the antecedent on the basis of language-specific constraints and preferences.

(Mitkov, 2002)
System Architecture [3]

- Before the implementation
  - A sample text analysis is performed to determine
    - The search scope for candidates
    - The constraints and preferences

- The sample contains
  - 8641 words with 455 third person personal and reflexive pronouns.
  - 285 of these pronouns were referring to proper person names.
System Architecture [4]

- With this analysis,
  - the sentence containing the pronoun and three preceding sentences are determined as the search scope.
  - 3 constraints and 8 preferences are determined for Turkish.
    - These are the constraints and preferences verified by a questionnaire on native Turkish speakers.
    - The statistical analysis is performed using Cochran’s Q test (Cochran, 1950).
System Architecture [5]

- The scores for the preferences are determined by training a perceptron:

<table>
<thead>
<tr>
<th>Preference</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quoted/Unquoted Text Preference</td>
<td>+2.20</td>
</tr>
<tr>
<td>Recency Preference</td>
<td>+2.15</td>
</tr>
<tr>
<td>Nominative Case Preference</td>
<td>+1.85</td>
</tr>
<tr>
<td>First NP Preference</td>
<td>+1.40</td>
</tr>
<tr>
<td>Nominal Predicate Preference</td>
<td>+1.20</td>
</tr>
<tr>
<td>Repetition Preference</td>
<td>+1.20</td>
</tr>
<tr>
<td>Punctuation Preference</td>
<td>+1.15</td>
</tr>
<tr>
<td>Antecedent of Zero Pronoun Preference</td>
<td>+1.05</td>
</tr>
</tbody>
</table>

Table 2.1 Optimized Preference Scores
System Architecture [6]

- Input texts are preprocessed to mark overt and zero pronouns in scope.

- Aforementioned steps are applied sequentially:
  - Identification of the anaphors to be resolved.
  - Location of the candidates for antecedents.
  - Selection of the antecedent on the basis of language-specific constraints and preferences.

- A dictionary of proper person names is used during candidate extraction.

- If no candidate survives, the pronoun is reported as ambiguous.

- The system outputs a paraphrased version of the original input
  - Pronouns are replaced with their proposed antecedents.
Constraints [1]

1. Number Agreement
2. Reflexive Pronoun Constraint
3. Personal Pronoun Constraint
Constraints [2]

1. Number Agreement

\( Aysel_1 \text{ okula gitti.} \)
\( Ayse \text{ school-DAT go-PAST} \)

\([Ahmet \text{ ve Fatma}_j \text{ onu}_i \text{ gordii.}] \)
\([Ahmet \text{ and Fatma]} \text{ she-ACC see-PAST} \)

\( \emptyset_j \text{ Ona}_i \text{ el salladilar.} \)
\( \text{She-DAT hand wave-PAST-PERS} \)

‘\( Aysel_1 \text{ went to school. [Ahmet and Fatma}_j \text{ saw her}_i \). (They)_j \text{ waved hand to her}_i.\)’
Constraints [3]

2. Reflexive Pronoun Constraint

\[ Ali_i \quad kendine_i \quad güvenir. \]
Ali himself-DAT trust-AOR
‘Ali trusts himself.’
Constraints [4]

3. Personal Pronoun Constraint

\[
\begin{align*}
Ayşe_i & \quad onu_j & \quad \text{gördü.} \\
Ayşe & \quad \text{she-ACC} & \quad \text{see-PAST} \\
\text{‘Ayşe}_i & \quad \text{saw her}_j.\\
\end{align*}
\]
Preferences [1]

1. Quoted/Unquoted Text Preference
2. Recency Preference
3. Nominative Case Preference
4. First Noun Phrase Preference
5. Predicate Nominal Preference
6. Repetition Preference
7. Punctuation Preference
8. Antecedent of Zero Pronoun Preference
Preferences [2]

1. Quoted/Unquoted Text Preference

“Bugün Ayşe’yi gördüm”
Today Ayşe-ACC see-PAST

dedi Zerrin.
say-PAST Zerrin.

“Ben de onu diün
I too she-ACC yesteday

görmüştim” dedi Murat.
see-PAST-PAST say-PAST Murat.

“(I) saw Ayşe today.” said Zerrin. “I had seen her yesterday too” said Murat.”
Preferences [3]

2. Recency Preference

\[ Ali \ oyun\ oynuyordu. \]
Ali game play-PROG-PAST

\[ Murat_{i} \ da \ geldi. \]
Murat too come-PAST

\[ \emptyset_{i} \ Oyunu \ sevdi. \]
Game-ACC like-PAST
Preferences [4]

3. Nominative Case Preference

“Ģünaydın” dedi Muratı.
“Good morning” say-PAST Murat.

Ali onaı baktı.
Ali he-DAT look-PAST.

“‘Good Morning’ said Muratı. Ali looked at himı.’
Preferences [5]

4. First Noun Phrase Preference

\[ Ahmet_{i} \ Ali^{y}i \ \text{gördü.} \ \Ø_{i} \ \text{Gülümsedi.} \]
\[ \text{Ahmet } \ Ali-\text{ACC see-PAST. } \text{Smile-PAST.} \]
\[ \text{‘Ahmet i saw Ali. (He) i smiled.’} \]
Preferences [6]

5. Predicate Nominal Preference

\[ Bu \ \text{çocuk} \ Ali_i \text{'ydi.} \]
This child Ali-PAST.

\[ \emptyset_i \text{Sinirli} \ \text{görünüyordu.} \]
Angry seem-PROG-PAST

‘This child was Ali_i. (He)_i seemed angry.’
Preferences [7]

6. Repetition Preference

\textit{Ayşe, parka gitti.}
\textit{Ayşe park-DAT go-PAST.}

\textit{Ø₁ Zeynep’le oyun oynadi.}
\textit{Zeynep-WITH game play-PAST.}

\textit{Ø₁ Şarkı söyledi.}
\textit{Song sing-PAST}

\textit{Ayşe, went to the park. (She)₁ played game with Zeynep. (She)₁ sang a song.’}
Preferences [8]

7. Punctuation Preference

Yolda Tekin'i, Ali'ye seslendi.
Way-LOC Tekin Ali-DAT call-PAST

Ø₁ Çok yorgundu.
Very tired-PAST.

‘On the way Tekin₁ called Ali. (He)₁ was very tired.’
Preferences [9]

8. Antecedent of Zero Pronoun Preference

\( \emptyset_i \) Eve yürüdü.
Home-DAT walk-PAST.

\( \emptyset_i \) Kapıda durdu.
Door-LOC stop-PAST.

\( \emptyset_i \) Kapıyı çaldı.
Door-ACC knock-PAST

‘(He)\( _i \) walked home. (He)\( _i \) stopped at the door. (He)\( _i \) knocked the door.’
Evaluation [1]

- 2 experiments are performed.
- A baseline algorithm, favoring the most recent candidate after the application of the constraints, is implemented.
- The metrics used are:

\[
\text{Recall} = \frac{\text{Number of pronouns correctly resolved}}{\text{Number of pronouns identified}}
\]

\[
\text{Precision} = \frac{\text{Number of pronouns correctly resolved}}{\text{Number of pronouns attempted}}
\]
Evaluation [2]

- A sample text from Metu Turkish Corpus (Say et al., 2002) is used:
  - 4140 words with 190 marked pronouns after preprocessing.

<table>
<thead>
<tr>
<th></th>
<th>Baseline Algorithm</th>
<th>Knowledge-poor System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall</td>
<td>68.4%</td>
<td>85.3%</td>
</tr>
<tr>
<td>Precision</td>
<td>70.6%</td>
<td>88%</td>
</tr>
</tbody>
</table>

Table 3.1 Results of the First Experiment
Evaluation [3]

- A Turkish child narrative is used:
  - 11315 words with 205 marked pronouns after preprocessing.

<table>
<thead>
<tr>
<th></th>
<th>Baseline Algorithm</th>
<th>Knowledge-poor System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall</td>
<td>65.8%</td>
<td>73.7%</td>
</tr>
<tr>
<td>Precision</td>
<td>81.3%</td>
<td>91%</td>
</tr>
</tbody>
</table>

Table 3.2 Results of the Second Experiment
Conclusion [1]

- A knowledge-poor pronoun resolution system for Turkish which uses limited syntactic knowledge to identify the antecedents of third person personal and reflexive pronouns in Turkish is presented.

- Providing evidence for the applicability of the knowledge-poor approach to Turkish.
Conclusion [2]

- As further studies:
  - the system can be extended to resolve pronouns with noun phrase (NP) antecedents,
  - it can be made to execute in fully automated mode by extending it with the ability to detect overt and zero pronouns that it will attempt to resolve.
References [1]

References [2]

References [3]


Thank you